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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte ROGER Y.B. YOUNG, JOHN A. KNOCH,
and JASON W. MCNICHOLS

Appeal 2010-000761
Application 10/628,614¹
Technology Center 2800

Before JOHN C. MARTIN, JOSEPH F. RUGGIERO, and MARC S. HOFF,
Administrative Patent Judges.

HOFF, *Administrative Patent Judge.*

DECISION ON APPEAL²

¹ The real party in interest is LSI Corporation.

² The two-month time period for filing an appeal or commencing a civil action, as recited in 37 C.F.R. § 1.304, or filing a request for rehearing, as recited in 37 C.F.R. § 41.52, begins to run from the “MAIL DATE” (paper delivery mode) or the “NOTIFICATION DATE” (electronic delivery mode) shown on the PTOL-90A cover letter attached to this decision.

STATEMENT OF CASE

Appellants appeal under 35 U.S.C. § 134(a) from a Final Rejection of claims 2-7 and 10-20.³ We have jurisdiction under 35 U.S.C. § 6(b).

We affirm-in-part.

Appellants' invention concerns semiconductor wafer edge defect inspection. An image capturing device, such as a camera or scanning electron microscope, sends wafer edge images to a database. A user accesses the wafer edge images and instructs a computer to perform a variety of analyses on one or more images at a time to discover the effects of various process steps in the fabrication system (Spec. 3-4).

Claim 2 is exemplary of the claims on appeal:

2. A method of inspecting a semiconductor wafer for defects using captured image analysis comprising:
 - positioning the wafer with an edge thereof relative to a scanning electron microscope;
 - rotating the wafer;
 - scanning the edge of the rotating wafer with the scanning electron microscope;
 - recording an image of the scanned wafer from the scanning electron microscope into a database;
 - instructing a computer to analyze the recorded images of the scanned wafer;
 - identifying any defects in the analyzed recorded images; and
 - upon identifying any defects, recording defect information related to each defect.

The Examiner relies upon the following prior art in rejecting the claims on appeal:

Wagner	US 5,659,172	Aug. 19, 1997
Tsui	US 6,906,794 B2	Jun. 14, 2005

³ Claims 1, 8, and 9 have been cancelled.

Strader US 7,013,222 B2 Mar. 14, 2006

Claims 4 and 16 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Tsuji.

Claims 2, 3, 5-7, 10-15, and 17-20 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Tsuji.

Throughout this decision, we make reference to the Appeal Brief (“App. Br.,” filed May 11, 2009) and the Examiner’s Answer (“Ans.,” mailed July 20, 2009) for their respective details. No reply brief has been filed.

ISSUES

With respect to claim 4, Appellants argue that Tsuji does not teach positioning an image capturing device at a desired angle relative to the edge of a wafer (App. Br. 11).

With respect to claim 16, Appellants contend that Tsuji does not teach the image capturing device automatically generating an image of the edge of a wafer (App. Br. 13-14).

With respect to claim 2, Appellants assert that Tsuji teaches away from the use of a scanning electron microscope (SEM) (App. Br. 14-15).

With respect to claim 3, Appellants argue that the Examiner has not explained why it would have been obvious to set an angle of the image capturing device, set a brightness of an illumination source, or set an accelerating voltage of an electron beam (App. Br. 17).

With respect to claim 5, Appellants’ position is that Tsuji does not teach or suggest selecting any manner for scanning an object or providing a specific pattern of images to be taken (App. Br. 17-18).

With respect to claim 6, 7, 11, 12, 15, and 17-19, Appellants assert that Tsuji fails to teach or suggest comparing defect information to previous defect information for that wafer (App. Br. 19).

With respect to claims 13 and 14, Appellants argue that Tsuji does not teach or suggest correlating each recorded image with the wafer from which it was taken and the process step after which it was taken (App. Br. 23).

Appellants' contentions present us with the following issues:

1. Does Tsuji teach positioning an image capturing device at a desired angle relative to the edge of a wafer?
2. Does Tsuji teach automatically generating an image of the edge of a wafer?
3. Does Tsuji teach or fairly suggest the use of a scanning electron microscope, given the Examiner's cited evidence that SEMs were known in the wafer defect inspection art?
4. Did the Examiner set forth why it would have been obvious to set an angle of the image capturing device, set a brightness of an illumination source, or set an accelerating voltage of an electron beam?
5. Does Tsuji teach or suggest selecting a scanning pattern for the edge of a wafer?
6. Does Tsuji teach or suggest comparing defect information recorded after the first process step to defect information recorded after the second process step?
7. Does Tsuji teach or suggest correlating each recorded image with the process step after which it was taken?

FINDINGS OF FACT

The following Findings of Fact (FF) are shown by a preponderance of the evidence.

Tsuji

T1. Tsuji teaches that imaging device 74 “is able to capture images at an arbitrary angle θ_2 with respect to the wafer edge portion of the wafer 2” (Fig. 6, col. 8 ll. 34-36).

T2. Tsuji teaches that “rotatable table 21 keeps rotating until the operator depresses the rotation stop button. In response to the rotation of the rotatable table 21, the imaging device 100 captures an image of the edge portion of the wafer 2 located under the objective lens 60” (col. 5, ll. 39-43; Fig. 3).

T3. Tsuji teaches comparing image data from a wafer under test to “the image data on the wafer 2 of good quality” (col. 9, ll. 1-2). “Alternatively, the wafers 2 of one lot are sequentially inspected, and each time a wafer 2 of good quality is determined, the image data of that wafer 2 is used as updating data” (col. 9, ll. 10-13).

PRINCIPLES OF LAW

“A rejection for anticipation under section 102 requires that each and every limitation of the claimed invention be disclosed in a single prior art reference.” *See In re Buszard*, 504 F.3d 1364, 1366 (Fed. Cir. 2007) (quoting *In re Paulsen*, 30 F.3d 1475, 1478-79 (Fed. Cir. 1994)).

“Section 103 forbids issuance of a patent when ‘the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains.”” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 405 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art, (2) any differences between the claimed subject matter and the prior art, (3) the level of skill in the art, and (4) where in evidence, so-called secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966). *See also KSR*, 550 U.S. at 407 (“While the sequence of these questions might be reordered in any particular case, the [*Graham*] factors continue to define the inquiry that controls.”)

ANALYSIS

CLAIM 4

Appellants argue that Tsuji does not anticipate claim 4 because Tsuji teaches movement of the objective lens in an X-Y plane perpendicular to the semiconductor wafer, and that such movement will not change the angle of the objective lens relative to the edge of the wafer (App. Br. 11).

We are not persuaded by Appellants’ argument. Tsuji teaches that imaging device 74 “is able to capture images at an arbitrary angle θ_2 with respect to the wafer edge portion of the wafer 2” (FF T1). Claim 4 does not limit the positioning of the image capturing device with respect to the edge of the semiconductor wafer to any particular plane. Further, claim 4 does not require that the step of “positioning the image capturing device at a desired angle relative to the edge of the wafer” be performed in the recited order of steps and therefore is broad enough to read on selecting an arbitrary angle of θ_2 (Fig. 6) prior to performing any of the other steps. *See Baldwin*

Graphic Sys. Inc. v Siebert, Inc., 512 F.3d 1338, 1345 (Fed. Cir. 2008) (“[A]lthough a method claim necessarily recites the steps of the method in a particular order, as a general rule the claim is not limited to performance of the steps in the order recited, unless the claim explicitly or implicitly requires a specific order.”) (citation omitted).

Tsuji thus meets the claim limitation “positioning the image capturing device at a desired angle relative to the edge of the wafer.”

Appellants’ further argument that the Examiner improperly relied on inherency (App. Br. 11-12) is not considered germane to the claimed invention, because the other method steps supposedly inherently performed – “magnification of the device, focus of the device, brightness of an illumination source, and the rotational speed of the wafer” (Ans. 4-5) – are not recited in claim 4.

Appellants have not established that the Examiner erred in rejecting claim 4 under § 102 as anticipated by Tsuji. Accordingly, we will sustain the rejection.

CLAIM 16

Appellants argue that Tsuji’s image capturing device does not automatically generate an image of the edge of the wafer, as required by the claim, because an operator must stop the rotation of the table by pressing the rotation stop button before the imaging device will capture an image of the edge of the wafer (App. Br. 13-14).

We are not persuaded by Appellants’ argument. We agree with the Examiner that Tsuji does not teach that *imaging device* is manually operated by a user (Ans. 9). Tsuji teaches that “rotatable table 21 keeps rotating until the operator depresses the rotation stop button. In response to the rotation of

the rotatable table 21, the imaging device 100 captures an image of the edge portion of the wafer 2 located under the objective lens 60” (FF T2). We agree with the Examiner’s finding that such operation corresponds to “automatic” image generation, as the term is understood by those skilled in the art (Ans. 9).

Because Appellants have not shown that the Examiner erred in rejecting claim 16 as being anticipated by Tsuji, we will sustain the § 102 rejection of claim 16.

CLAIM 2

Appellants argue that the Examiner erred in rejecting claim 2 as obvious over Tsuji because the claim calls for a scanning electron microscope (SEM), in which magnification is not a function of the power of the objective lens, whereas Tsuji teaches replacing a small magnification objective lens with a large magnification objective lens to enable a defective portion of a wafer to be displayed enlarged and examined in detail (App. Br. 14-15). According to Appellants, such disclosure in Tsuji means not only that Tsuji does not teach a SEM, but actively teaches away from the use of a SEM (*id.*).

We are not persuaded by Appellants’ argument. The Examiner correctly points out that the obviousness rejection proposes modifying Tsuji to include a scanning electron microscope rather than a conventional camera or microscope, in order to provide better image information (Ans. 5). The Examiner’s rejection does not call for an objective lens of any particular size (Ans. 10-11). Further, we agree with the Examiner’s finding, supported by the evidence of the Wagner and Strader patents, that SEMs were known to be used to capture images in a wafer defect inspecting system (Ans. 10).

Tsuji's disclosure regarding the size of the optical objective lens would not have been perceived by person having ordinary skill in the art as discouraging the replacement of Tsuji's optical imaging device and objective lens with an SEM having an objective lens.

Because Appellants have not shown that the Examiner erred in rejecting claim 2, we will sustain the § 103 rejection.

CLAIM 3

Appellants argue that the Examiner's rejection is erroneous because the Examiner did not address the claim limitations of setting an angle of the image capturing device relative to the edge of the wafer, setting a brightness of an illumination source that illuminates the edge of the wafer, or setting an acceleration voltage of an electron beam (App. Br. 16-17). The Examiner responds that he did not include a discussion of these limitations because they had been addressed in the Final Rejection (Ans. 11).

We are persuaded by Appellants' arguments. In reviewing the Final Rejection, we observe that the Examiner does *not* explain the obviousness of setting the brightness of an illumination source that illuminates the edge of the wafer. Appellants' further limitation of setting an acceleration voltage of an electron beam is simply asserted to have been obvious for "similar" reasons as those set forth for replacing the optical microscope of Tsuji with a scanning electron microscope. Even if we assume *arguendo* that the Examiner is correct that setting an acceleration voltage would have been obvious when, as recited in parent claim 2, the wafer is scanned by an SEM, the Examiner has failed to establish the *prima facie* obviousness of claim 3 because he has not established why it would have been obvious to set the brightness of an illumination source, as claimed.

Because Appellants have shown that the Examiner erred in rejecting claim 3, we will not sustain the § 103 rejection.

CLAIM 5

Appellants argue that Tsuji does not disclose scanning the edge of the wafer from a region interior of a top of the edge to a region exterior of a bottom of the edge (App. Br. 17), that the Examiner's rationale that selecting a specific pattern would have been obvious "to provide a better image pattern to be recorded or stored or displayed" is a conclusory statement of the type "ruled legally insufficient by both Supreme Court [sic] and the Federal Circuit" (App. Br. 17-18), and that in any case Tsuji teaches that any scanning pattern is selected manually by an operator, rather than automatically (App. Br. 17-18).

We do not agree with Appellants. The Examiner finds that Tsuji may lack "a clear inclusion of any selection of scanning manner" (Ans. 11) but does disclose an optical inspection system including an identification mark, and that "if there is a need for recognizing an identification mark, in the inner side of the edge portion and/or its neighboring portions . . . , the imaging device can be moved to the location/position where the mark is located" (Ans. 11-12). The Examiner then concludes, and Appellants do not rebut, that it would have been obvious to modify Tsuji to select the specific scanning manner claimed "if the desired inspection of the edge portion and its neighboring portions (of the wafer) were needed . . . This would [also] provide an image pattern of imaged defect information of different types, areas and sizes to be stored/recorded or displayed to the user of the system" (Ans. 12).

Because Appellants have not shown that the Examiner erred in rejecting claim 5 as being obvious over Tsuji, we will sustain the § 103 rejection.

CLAIM 6

Appellants argue that the Examiner erred in rejecting claim 6 because Tsuji does not teach comparing defect information recorded after the first process step to the defect information recorded after the second process step. The Examiner asserts that the rejection is proper because although Tsuji only teaches comparing image data of a wafer under inspection with image data of a “wafer of good quality,” Tsuji also teaches that each time a wafer of good quality is determined, the image data of that wafer is used to update the data concerning a wafer of good quality (Ans. 12-13; FF T3).

Appellants’ arguments have persuaded us of Examiner error. Even assuming that the Examiner is correct that image data concerning a wafer of good quality is occasionally updated, Tsuji does not teach that, *for every inspection process*, defect information recorded after the first process step is compared to defect information recorded after the second process step, as claim 6 clearly requires. If the first process step does not reveal a “wafer of good quality,” Tsuji’s invention teaches that the image recorded after the second process step would be compared with an image from some other “wafer of good quality,” rather than an image of the same wafer after the first process step.

Accordingly, Appellants have shown that the Examiner has failed to set forth the prima facie obviousness of claim 6. We will thus not sustain the § 103 rejection of claim 6.

CLAIM 7

Appellants argue, just as with claim 6, that Tsuji does not teach or suggest comparing the defect information recorded after the first process step to the defect information recorded after the second process step (App. Br. 20-21). Because we find *supra* that the Examiner erred in rejecting claim 6 under § 103 as obvious over Tsuji, we will not sustain the § 103 rejection of claim 7, for the same reasons.

CLAIM 10

Appellants rely on the patentability of claim 4 as the basis for the patentability of claim 10 (App. Br. 22). Because we find *supra* that the Examiner did not err in rejecting claim 4 as anticipated by Tsuji, then, we will sustain the Examiner's § 103 rejection of claim 10, for the same reasons.

CLAIMS 11, 12, 15, AND 17-19

For these claims, Appellants rely on the arguments made for claims 6 and 7. Because we find *supra* that the Examiner erred in rejecting claims 6 and 7 as obvious over Tsuji, we will not sustain the § 103 rejection of claims 11, 12, 15, and 17-19, for the same reasons.

CLAIM 20

Appellants contend that claim 20 is patentable for the same reasons claim 16 is believed to be patentable (App. Br. 25). Because we sustain the § 102 rejection of claim 16 as anticipated by Tsuji, we will also sustain the rejection of claim 20 under § 103 over Tsuji, for the same reasons.

CLAIMS 13 AND 14

We select claim 13 as representative of this group of claims, pursuant to our authority under 37 C.F.R. § 41.37(c)(1)(vii).

Appellants argue that the Examiner erred in rejecting claims 13 and 14 because Tsuji does not teach or suggest correlating each recorded image with the process step after which it was taken, as independent claim 13 requires.

We are not persuaded by Appellants' argument. The Examiner finds, and Appellants do not contest, that Tsuji discloses

an operation screen which can display which portion of the wafer is being observed at the present time while a portion of the wafer with defects detected by the image processing is also displayed on the wafer map. These performances of the operation screen are considered similar to the correlating operations/performances claimed by the present application.

Ans. 15.

Because Appellants have filed no Reply Brief rebutting this finding, we do not find error in the Examiner's conclusion of the obviousness of claims 13 and 14. Therefore, we will sustain the § 103 rejection of these claims.

CONCLUSIONS

1. Tsuji teaches positioning an image capturing device at a desired angle relative to the edge of a wafer.

2. Tsuji teaches automatically generating an image of the edge of a wafer.

3. Tsuji fairly suggests the use of a scanning electron microscope, given the Examiner's cited evidence that SEMs were known in the wafer defect inspection art.

4. The Examiner failed to set forth why it would have been obvious to set an angle of the image capturing device, set a brightness of an illumination source, or set an accelerating voltage of an electron beam.

5. Tsuji suggests selecting a scanning pattern for the edge of a wafer.

6. Tsuji does not teach or suggest comparing defect information recorded after the first process step to defect information recorded after the second process step.

7. Tsuji suggests correlating each recorded image with the process step after which it was taken.

ORDER

The Examiner's rejection of claims 2-4, 10, 13, 14, 16, and 20 is affirmed. The Examiner's rejection of claims 5-7, 11, 12, 15, and 17-19 is reversed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a).

Appeal 2010-000761
Application 10/628,614

AFFIRMED-IN-PART

ELD

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